KIRTLANDIA

THE CLEVELAND MUSEUM OF NATURAL HISTORY

CLEVELAND, OHIO SEPTEMBER 12, 1968 NUMBER 3

PACHYLOCRINIDS FROM THE CONEMAUGH GROUP, PENNSYLVANIAN

J. J. Burke

ABSTRACT

Four new species of pachylocrinid inadunate crinoids from the Conemaugh Group, Pennsylvanian, are described and attributed to the genus *Plummericrinus*. Three of these forms, *P. monongaliensis* sp. nov., presumably from the Brush Creek Limestone, Monongalia County, West Virginia, *P. emilyae* sp. nov., from the Ames Limestone, Carroll County, Ohio, and *P. pittsburghensis* sp. nov. from the Ames Limestone, Allegheny County, Pennsylvania, have dorsal cups with slight interradial notches, pits at the corners of the cup plates, and generally resemble *P. colubrosus* (Moore) although the cups are bowl-shaped rather than subpyriform; a fourth species, *P. nettingi* sp. nov., from the Cambridge Limestone, Allegheny County, Pennsylvania, has a truncate cone-shaped cup, prominent interradial notches and the characteristic splay-toothed outline of *P. mcguiri* (Moore).

The presence, in *P. monongaliensis* sp. nov., of muscular articulations connecting anal X and the right tube plate with the two tube plates overlying them is taken to indicate that some flexion of the anal tube was possible in this and other pachylocrinid species where similar articulations characterize these anal plates.

Four new species of pachylocrinid inadunate crinoids are described in the present paper and attributed to the genus *Plummericrinus*. The specimens on which the descriptions are based are from the Conemaugh Group, Upper Pennsylvanian, of Ohio, West Virginia and Pennsylvania. In addition to material from the Cleveland Museum of Natural History, specimens described herein or used for comparative study were borrowed from the Carnegie Museum and the United States National Museum. I am grateful to the authorities of these institutions for permission to study and to describe these specimens.

I wish to acknowledge the assistance of Mr. Bruce Frumker for photography, and my wife, Emily, for arranging the illustrations.

SYSTEMATIC PALEONTOLOGY

Family PACHYLOCRINIDAE Kirk, 1942

Genus **PLUMMERICRINUS** Moore and Laudon, 1943

PLUMMERICRINUS MONONGALIENSIS[1] sp. nov.

Fig. 1

Diagnosis: Dorsal cup about as wide as that of *Plummericrinus colubrosus* (Moore) but higher (form ratio .54) and bowl-shaped, rather than subpyriform; walls of basal concavity less steep, infrabasals and basals less reduced. Interradial notches slight, pits at corners of cup plates, radianal strongly reduced, brachials without keels.

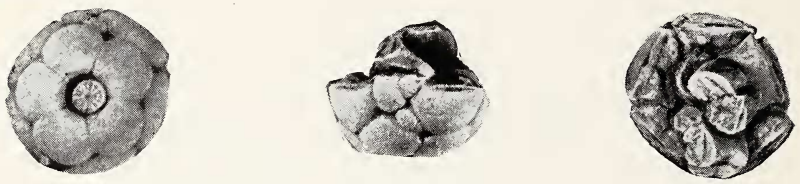

Fig. 1. *Plummericrinus monongaliensis* sp. nov. Holotype, a dorsal cup, U.S.N.M. no. 27488, from the ?Brush Creek Limestone, Conemaugh Group, Monongalia County, West Virginia. *a*, dorsal view; *b*, posterior view; *c*, ventral view, ×3.

Holotype: U.S. National Museum no. 27488, a dorsal cup with first two primibrachs (B and C rays) and first two secundibrachs (B ray).

Occurrence: ?Brush Creek Limestone, Conemaugh Group, Upper Pennsylvanian.

Locality: Monongalia County, West Virginia.

Repository: United States National Museum, Washington, D.C.

Description: The dorsal cup of this species is truncate bowl-shaped; the outline in dorsal and ventral view is subround and asymmetrical because the plates of the posterior interradius and the right posterior radial bulge outward to some extent. There is a distinct basal impression, which is relatively deep for *Plummericrinus*; its diameter is about one-third that of the cup. The proximal portion of the round stem is preserved; the articular surface of one colum-

[1] Named for Monongalia County, West Virginia.

nal shows 14 culmina and a subpentagonal lumen. The infrabasals extend beyond the stem, flaring downward steeply to meet the basals. The basals participate in the basal concavity and are strongly curved proximally; beyond the basal plane they are rather gently convex both longitudinally and transversely. These plates are only slightly wider than high, and are not impressed along their common sutures, but gentle furrows mark the sutures between the basals and the radials. At the tips of the radials and the basals there are definite deep pits at the plate junctions.

The radial plates are about a third wider than high. They are more convex longitudinally than transversely, but not strongly convex in any case. The furrows along the interradial sutures are stronger than those along the radial-basal sutures, however. There are definite but not pronounced interradial notches at the summits of these plates.

The radial articular surface is nearly as wide as the radial plate, although the transverse ridge is not. In lateral view, the outer marginal ridge sags downward with a gentle arcuate curve. In ventral view, the ridge has a stronger arcuate outline and bounds a relatively deep outer ligament area. The marginal ridge is not sharply delimited from the adjacent ligament area, which is denticulate. The ligament pit furrow is slitlike and not strongly excavated; the ligament pit is also slitlike. The transverse ridge is distinct and not denticulate. The inner ligament area is somewhat deeper than the outer. The oblique fossae are prominent, and a wide intermuscular notch separates the two triangular muscle areas, which face outward strongly.

Three plates occupy the posterior interradial area. Pits and furrows mark their junctions *inter se* and with adjoining basals and radials. Of these plates, anal X is the largest. The radianal is about half the size of anal X, and the right tube plate is about one-third as large as anal X. Anal X abuts against the left posterior radial and rests on the truncated tip of the posterior basal and the upper side of the radianal. Below the right tube plate it makes contact with the right posterior radial; above that place the triangular right tube plate is wedged between anal X and the right posterior radial. The radianal is an elongate triangle; below its contact with anal X it is obliquely disposed between the posterior basal and the right posterior radial; it narrows to a tip and barely contacts the right posterior basal below. There is a distinct pit shared by the four plates

at this place of contact. Between the anal X and the posterior basal, there is a deep furrow, rather than a pit, and there is also a furrow marking the contact between anal X and the right posterior radial. Both anal X and the right tube plate extend only slightly higher than the summits of the radials and their distal articular surfaces lie in the same plane. Both plates resemble the radials in having external ligament furrows and pits, but the furrows and pits are less slitlike. These plates also exhibit transverse ridges and broad flat internal ligament areas.

The primibrachs of the B and C rays are present. They are wider than high, do not have median keels, and are axillary. The axillary face of the B ray primibrach is showing; it is divided by a median ridge into two articular surfaces, one for each first secundibrach. Each of these articular surfaces is composed of inner and outer ligament areas separated by a transverse ridge. The outer ligament areas are denticulate; the outer ligament pits lie within furrows. The two first secundibrachs of the C ray are also preserved. They are a little wider than high and nonaxillary. The upper articular surfaces show definite transverse ridges and inner and outer ligament areas resembling those of the radials. The outer ligament areas show denticulation.

Very fine granulose ornamentation is visible on the cup and brachial plates at a magnification of 20×.

Discussion: It is of interest to note that in this species the distal surfaces of anal X and the right tube plate are in essentially the same plane. Strimple (1961, p. 98) noted that in *Haerteocrinus, Texacrinus,* and *Plummericrinus* there is a trend toward this arrangement of these plates. Strimple has noted also (1952, p. 246) that in *Haerteocrinus turbinatus* "The upper surfaces of both RX and X have muscular fossae somewhat comparable to those of the RR. There is an outer ligament pit bordered by a transverse ridge. The outer marginal ridge and transverse ridge possess denticles, and other crenulations are found behind the muscle scar. Intermuscular notches are narrow and well defined, that of anal X being to the left of center, and of RX to the right of center."

This description in general applies to the facets of these anal plates in *P. monongaliensis* also. Furthermore, I have removed the matrix from the distal facets of these plates in the holotype of *P. mcguiri* (U.S.N.M. no. 141074); they show the same structures

noted by Strimple and the visible portion of the proximal facet of the large tube plate that succeeds anal X has a similar articular surface. A succeeding tube plate partly covers the distal surfaces of anal X and the right tube plate in the holotype of *P. colubrosus* (U.S.N.M. no. 141091) and I have not been able to make full preparation of the articular structures, but it is evident that they are much like those shown in *P. mcguiri.* In both of these Permian species the distal articular surfaces of anal X and the right tube plate are in approximately the same plane, as in *P. monongaliensis.* It is also worth noting that the largest plates of the tegminal sacs of *P. mcguiri* and *P. colubrosus* are in two rows, initiating with anal X and the right tube plate.

It appears evident that in some species of *Haerteocrinus, Texacrinus* and *Plummericrinus,* anal X and the right tube plate were joined to the two tube plates distal to them by muscular articulation. Furthermore, because in certain of these species the distal articular surfaces of anal X and the right tube plate are in the same plane, it is obvious that these two plates formed a common hinge with the proximal articular surfaces of the two tube plates immediately overlying them.

Because these anal plates were connected by muscular union of the same type as that which connected the arm plates of these species, it follows that some movement of the anal tube must have been possible—approaching, at least, that which was attained by the arms. In the case of *Plummericrinus* this is of special interest. Moore (1939, p. 221), because of the proximal location of what appeared to be the anal vent in *P. colubrosus,* stated that "this suggests that the main part of the tube functions mainly in connection with respiration or the water circulatory system rather than as covering for an elongated convoluted gut." Possibly, if such were the case, movement of the tube contributed in some way to respiration or circulation of water.

Muscular articulation of this type is confined to the opposed faces of these pairs of anal plates of the anal tube in *P. mcguiri,* at least. In making further preparation of the holotype specimen of that species I uncovered two small plates of a row which originates at the left distal corner of the tube plate which overlies anal X. However, most of the distal surface of the latter tube plate articulated with a second large plate above, to the right of which I exposed another large plate which articulated with the plate which

rested above the right tube plate. Of these additional plates, all of the articular faces that are showing have moderate to deep fossae, with rims which, on the external side, at least, are crenulated. This type of articulation is usually interpreted as ligamentary. However, this does not rule out the possibility that contractile fibers might have been present, which would have contributed to flexion of the tube.

Of the anal plates within the dorsal cup of *Plummericrinus monongaliensis,* both anal X and the radianal are reduced, although anal X is still functional, as indicated by the articular surface noted previously. The separation of anal X from the radianal is unusual. I have not seen this condition in any other specimen of *Plummericrinus.* It may be only a simple case of variation and not characteristic of the species. However, coupled with the reduction of the radianal, it suggests that in this species we may be dealing with a trend toward loss of the radianal through resorption.

The specific locality and horizon from which this excellent little specimen was taken cannot be determined with certainty. I found it in the fossil crinoid collection of the United States National Museum. It is identified on the original handwritten label as *"Hydreionocrinus discus* (Meek & W.)" by "C.S." with the notation "Upper Carb./locality lost." Another label (typewritten) gives the same information but adds "Found among Monongalia Co., W.Va. fossils (C.S.)." I gather that the "C.S." refers to Charles Schuchert.

It appears quite likely that this dorsal cup is the specimen noted as *"Erisocrinus,* undetermined species" by Meek (1871) in a list of fossils reported by Stevenson (1871) to have been taken from the Uffington Shale, Conemaugh Group, near Morgantown, W.Va. The fossils listed were embodied in the United States National Museum collection, but many of them cannot be found at the present time. It has since been determined (Price, 1917; Murphy, 1966) and from my own field observations, that the Uffington Shale in the Morgantown area does not carry a marine fauna, and that the fossils identified by Meek probably came from the Brush Creek Limestone. It was my impression, in the course of preparation of the holotype of *Plummericrinus monongaliensis* that the matrix adhering to the specimen was characteristic of the Brush Creek, and Mr. James Murphy, who has collected marine fossils from the Brush Creek in the Morgantown area, is of the same opinion (personal communication, Feb. 16, 1968).

Linear measurements of the holotype, in millimeters, are given below:

Height of dorsal cup	3.7
Greatest width of cup	6.9
Ratio of height to width	0.54
Height of basal concavity	0.6
Width of basal concavity	2.3
Width of infrabasal circlet	1.9
Height of basal (raB)	2.6
Width of basal (raB)	2.8
Height of radial (aR)	2.3
Width of radial (aR)	3.5
Width of transverse ridge (aR)	3.3
Length of suture between basals	1.5
Length of suture between radials	1.1
Height of radianal	1.3
Width of radianal	1.3
Height of anal X	1.5
Width of anal X	1.3
Height of right tube plate	0.9
Width of right tube plate	0.8
Height of first primibrach (C ray)	2.3*
Width of first primibrach (B ray)	3.1
Height of first secundibrach (B ray)	2.0
Width of first secundibrach (B ray)	2.2

* Approximate

PLUMMERICRINUS NETTINGI[2] sp. nov.

Fig. 2

Diagnosis: Dorsal cup resembling that of *Plummericrinus mcguiri* (Moore) in having prominent interradial notches, outflaring radials and lacking pits at corners of plates, but differing in smaller size (width 13.8 mm) and in tending toward truncate-cone shape, with shallower basal concavity and less elongate basals and radials.

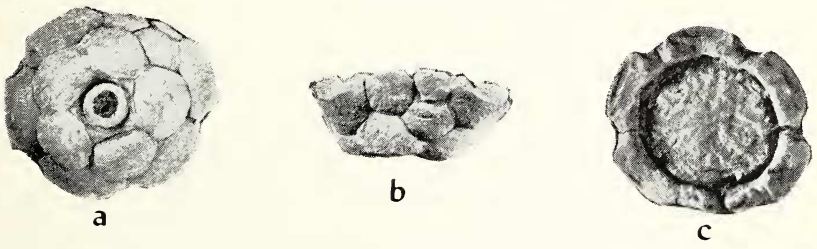

Fig. 2. *Plummericrinus nettingi* sp. nov. Holotype, a dorsal cup, Carnegie Museum no. 29857, from the Cambridge Limestone, Conemaugh Group, near Verona, Allegheny County, Pennsylvania. *a*, dorsal view; *b*, posterior view; *c*, ventral view, ×2.

[2] Named for Dr. M. Graham Netting, Director, Carnegie Museum.

Holotype: Carnegie Museum no. 29857, a dorsal cup.

Occurrence: Cambridge Limestone, Conemaugh Group, Upper Pennsylvanian.

Locality: Sylvan Run, near Verona, Allegheny County, Pa. (Lat 40° 29′ 25″ N, Long 79° 50′ 50″ W).

Repository: Carnegie Museum, Pittsburgh, Pa.

Description: The dorsal cup of this crinoid is modified truncate cone-shaped. In dorsal view the rounded outline of the basal circlet is in marked contrast with the scalloped outline of the radial circlet resulting from prominent interradial notches at the summits of the outflaring radial plates.

The outer ring of one columnal of the round stem is preserved and shows faint traces of culmina. The basal concavity is distinct. The width of the concavity is less than one-third that of the cup, but the height is only about one-seventh of the cup height.

The infrabasals are relatively prominent, with tips extending well beyond the stem. These plates are slightly convex and slope downward gently to meet with the basals.

The basals participate in the basal concavity and are sharply convex longitudinally in that region. Beyond the concavity the basals are moderately convex. These plates are almost a fifth wider than high. There are gentle furrows along the sutures between the basals, and distally the tips of the basals are sharply incurved to meet the interradial sutures.

The radials are about half as high as wide and flare outward strongly in the midregion, where they show little curvature. Along the sides, however, they are distinctly incurved, producing distinct hollows that border the interradial sutures. There are prominent interradial notches, with broad slopes, and the articular surface does not occupy the full width of the radial.

In general, the radial articular surfaces are not strongly developed and they are not well defined. The outer ligament area may be described as deep, although less so than the inner ligament area. The outer marginal ridge is arcuate, and the ligament area is denticulate. The ligament-pit furrow is slitlike, but I cannot distinguish a distinct ligament pit. There is a fairly strong transverse ridge, which is not denticulate. The inner ligament area displays moderate oblique fossae and outward-facing muscle areas, sepa-

rated by a broad intermuscular notch. There are also traces of the intermuscular furrow.

The radianal is the largest plate of the posterior interradius. Proximally it is wedged in between the posterior basal and the right posterior basal. Laterally it contacts anal X on the left and the right posterior radial on the right. Distally it bears the right tube plate, which intervenes between the right posterior radial and anal X. Anal X is somewhat smaller than the radianal; in addition to its contacts with the radianal and the right tube plate it rests on the truncate tip of the posterior basal below and also abuts against the left posterior radial on the left. The right tube plate is much smaller than the other two anal plates. The superior surfaces of anal X and the right tube plate are damaged and I cannot determine their original structure. The right tube plate is somewhat out of place and overrides the underlying radianal slightly. Probably the superior surfaces of anal X and the right tube plate were in essentially the same plane.

The ornamentation consists of small irregular pustules, visible at a magnification of 10×. It appears to have been absent from the infrabasals and proximal portions of the basals.

Discussion: As the diagnosis indicates, this form is quite distinct from the other Conemaugh species described in this paper, particularly in showing strong interradial notches and outflaring radial plates. In these respects it resembles the Permian *Plummericrinus mcguiri* (Moore), although differing from that species in its smaller size, different shape of the dorsal cup, shallower basal concavity and less elongate basals and radials. However, none of these characteristics would appear to bar it from the ancestry of the Permian species.

Linear measurements of the holotype, in millimeters, are as follows:

Height of dorsal cup	5.4
Greatest width of cup	13.8
Ratio of height to width	0.39
Height of basal concavity	0.8
Width of basal concavity	4.2
Width of infrabasal circlet	4.4
Height of basal (raB)	3.6
Width of basal (raB)	4.7
Height of radial (aR)	3.4
Width of radial (aR)	6.0
Width of transverse ridge (aR)	4.8
Length of suture between basals	1.7

Length of suture between radials	2.2
Height of radianal	4.0*
Width of radianal	3.7
Height of anal X	3.0
Width of anal X	3.4
Height of right tube plate	1.9
Width of right tube plate	2.5

* Estimated

PLUMMERICRINUS EMILYAE[3] sp. nov.

Fig. 3

Diagnosis: A species resembling *Plummericrinus colubrosus* (Moore) in showing slight development of interradial notches and in having pits at corners of cup plates, but a larger form (estimated crown height 34 mm, width of dorsal cup about 10 mm) having cup more bowl-shaped and basal concavity quite shallow, infrabasals and basals less reduced, summits of anal X and right tube plate not in same plane and keels of brachials absent or insignificant.

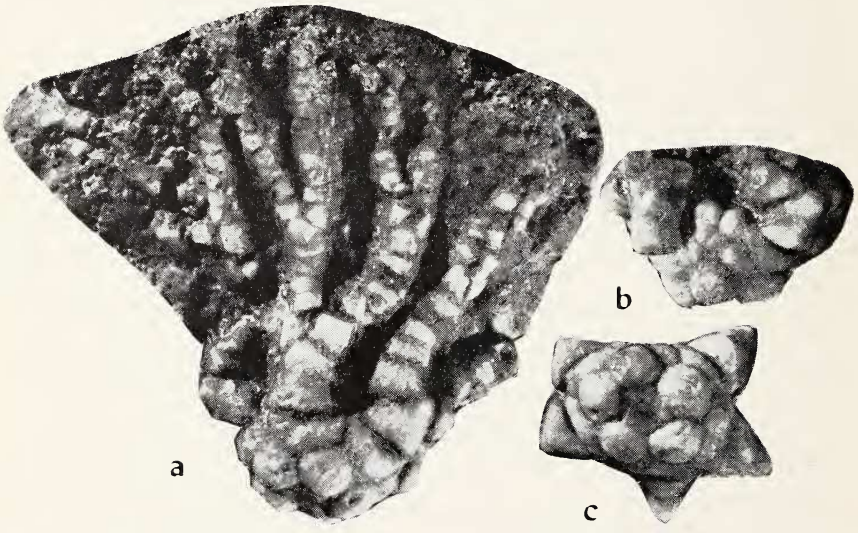

FIG. 3. *Plummericrinus emilyae* sp. nov. Holotype, a dorsal cup with portions of the arms attached, Cleveland Museum no. 4000, from the Ames Limestone, Conemaugh Group, about 3 miles east of Carrollton, Carroll County, Ohio. *a*, anterior view; *b*, posterior view; *c*, dorsal view, ×2.

[3] Named for my wife, Emily G. Burke.

Holotype: Cleveland Museum no. 4000, a dorsal cup with portions of the arms attached.

Occurrence: Ames Limestone, Conemaugh Group, Upper Pennsylvanian.

Locality: Joe Skinner Quarry, NW¼NE¼ sec. 13 (Lat 40° 34′ 20″ N, Long 81° 01′ 20″ W) Center Township, about 3 miles east of Carrollton, Carroll County, Ohio.

Repository: Cleveland Museum of Natural History, Cleveland, Ohio.

Description: Unfortunately, this specimen is contained in a very adherent matrix, and despite reasonable care in preparation, the component plates of the crown suffered some abrasion, although not to the extent that most of the salient characteristics were destroyed.

None of the arms is complete, but by conservative estimate the height of the crown was at least seven times that of the dorsal cup. The dorsal cup is truncate bowl-shaped. The stem is not preserved. Although the base of the cup has been abraded, it is evident that there is a distinct basal impression, the width of which is slightly more than one-third of the width of the cup; however, the maximum height of the impression, at most, is somewhat less than one millimeter. The stem impression is relatively small, a little less than a third as wide as the infrabasal circlet, consequently the infrabasal plates extended well beyond the stem. The greatest height of the basal impression is in the vicinity of junction of the infrabasal and basal plates; the stem impression does not extend to the basal plane of the cup, but the infrabasals flare upward slightly to meet the basals, and most of the wall of the impression is formed by the proximal portions of the basals.

The basal plates are a little more than one-fifth higher than wide. The left posterior appears to retain approximately its original slopes. Proximally, these plates show strong upward curvature, forming the walls of the basal impression. Distally, the longitudinal curvature is less pronounced; laterally, especially in the area between the basal sutures, the curvature is again strong, although somewhat less so than in the proximal region. These slopes form hollows bordering the basal sutures; there are also hollows, although generally broader, between the basals and the radials.

Apparently there were pits at all the angles where the basals meet with the radials and the anal plates, but traces of some of them have been obliterated.

The radials are nearly twice as high as wide. In general they tend to flare outward, their slopes diverging somewhat from those of the basals, although the tendency is not pronounced. These plates for the most part are nearly as convex as the basals along their height and are moderately convex transversely. Distally they curve inward strongly along a lunate area that sags downward from the summit corners of the plates; a similar upward arching area shows in the proximal portion of the primibrachs, consequently the sutures between the radials and the primibrachs are gaping. Interradial notches are present, but they are very slight. Except for the left anterior radial, which shows a trace of the outer ligament pit, details of the articular surfaces are concealed because the first primibrachs are all preserved.

The radianal plate is the largest of the anal plates; the right and left plates are somewhat smaller and anal X is slightly smaller than any of the others. The radianal extends proximally to the suture between the right posterior basal and the posterior basal. It abuts by a short side against the right posterior basal; a longer side borders the right posterior radial, and another long side rests against the posterior basal. A shorter side on the left contacts anal X. Above, the radianal supports the right tube plate, which fits in between the right posterior radial and anal X. The right tube plate extends for about half its height above the summit of the right posterior radial; on the left, above anal X, it rests against the left tube plate. Anal X rests on the truncate tip of the posterior basal below, and for most of its height contacts the left posterior radial, although it extends slightly above the summit of that plate. Above, it supports the left tube plate.

The first primibrachs of the A and C rays are higher than wide; those of the other rays are wider than high. These plates were abraded in preparation, but some of them now show sharp ridges along the midline that may be traces of keels. These plates are axillary. The right division of the A ray is complete to a short distance beyond the third isotomous division of the inner branch. There are six secundibrachs; the sixth is axillary. Ten tertibrachs are preserved in the outer ray and no evidence of branching. However,

the inner ray shows nine tertibrachs and the ninth is axillary. Four quartibrachs remain on one side following the bifurcation, one on the other. On the inner branch of the left division of the A ray, both first quartibrachs are preserved, resting on the axillary tertibrach. I find no evidence of tertiary division in either of the outer branches of the A ray.

A few slender pinnules are showing along the sides of some of the arms.

Discussion: This specimen is of interest because it shows the arm structure of the species, at least in part. Branching takes place on the first primibrach and again on the sixth secundibrach or thereabouts. From this point on there is no indication, from what is showing, of any further bifurcation on the outer branches, but the inner branches bifurcate again at the ninth tertibrach, as shown in one branch at least. This type of arm structure also characterizes *Texacrinus*, wherein, because the outer branches fail to show further bifurcation, the structure is termed exotomous. However, no species of *Plummericrinus* of which I know differs from *Texacrinus* in this respect, that is, they do not show any further bifurcation of these outer branches, so exotomous arm structure does not constitute a valid generic distinction between *Texacrinus* and *Plummericrinus*.

As a matter of fact, generic distinction between *Texacrinus* and *Plummericrinus* finds little support when based on other characters as well. Moore (1940, p. 144) cited the absence of interradial notches in the holotype of *Texacrinus gracilis*, but the presence or absence of these notches is not regarded as a generic character in other inadunate crinoids; *Plaxocrinus*, for example, is composed of species some of which exhibit the notches, whereas others do not. The interposition of the radianal between the posterior basal and anal X appears to have been regarded as a generic character of *Texacrinus* by Strimple (1961, p. 94). However, variations in the arrangement of these anal plates will quite likely be found in species of *Texacrinus*. As regards *Plummericrinus*, the radianal separates anal X from the posterior basal in the holotype of *P. bellirugosus*. It is also interesting to note that in four paratypes of *P. mcguiri*, Moore (1939, p. 209) found the radianal separating anal X from the posterior basal.

The slight basal impression shown in *P. emilyae* constitutes at best a specific distinction that points up the transition in this respect from genera such as *Haerteocrinus,* in which the impression is lacking. Of more significance, it seems to me, is the fact that in *P. emilyae* the distal surfaces of anal X and the right tube plate are not in the same plane. In this respect *P. emilyae* appears to differ from most, if not all, other species of *Plummericrinus.*

Linear measurements of the holotype, in millimeters, are given in the following tabulation:

Height of crown	34.0*
Height of dorsal cup	4.9**
Greatest width of cup	10.1**
Height of basal concavity	0.7**
Width of basal concavity	3.7
Diameter of stem impression	1.0**
Width of infrabasal circlet	3.2
Height of basal (laB)	4.4
Width of basal	3.7
Height of radial (laR)	2.5
Width of radial (laR)	4.8
Length of suture between basals	1.6
Length of suture between radials	1.4
Height of radianal	2.3
Width of radianal	2.3
Height of anal X	1.8
Width of anal X	1.8
Height of right tube plate	2.0
Width of right tube plate	2.0
Height of left tube plate	2.0
Width of left tube plate	2.0
Height of first primibach (A ray)	4.3
Width of first primibach (A ray)	4.2
Height of first secundibrach (A ray)	2.8
Width of first secundibrach (A ray)	2.5
Height of first tertibrach (A ray)	1.5
Width of first tertibrach (A ray)	1.6

* Estimated

** Approximate

PLUMMERICRINUS PITTSBURGHENSIS[4] sp. nov.

Fig. 4

Diagnosis: Dorsal cup truncate bowl-shaped, estimated width 15 mm; interradial notches slight, pits at corners of plates; plates only moderately convex; basals, radianal and anal X relatively large; posterior basal makes narrow contact with anal X; primibrachs without keels.

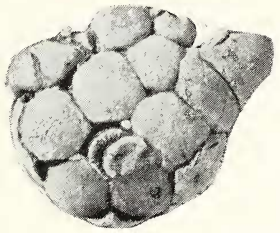

Fig. 4. *Plummericrinus pittsburghensis* sp. nov. Holotype, an obliquely crushed dorsal cup, Carnegie Museum no. 29858, from the Ames Limestone, Conemaugh Group, Brilliant Cutoff, Pittsburgh, Allegheny County, Pennsylvania. Dorsal view, ×2.

Holotype: Carnegie Museum no. 29858, a dorsal cup with primibrachs of the C and D rays attached.

Occurrence: Ames Limestone, Conemaugh Group, Upper Pennsylvanian.

Locality: Brilliant Cutoff (Lat 40° 29′ N, Long 79° 54′ 20″ W) Pittsburgh, Allegheny County, Pennsylvania.

Description: Although the dorsal cup of the type has undergone compression, which makes it extremely difficult to determine the original outlines and dimensions, the specimen nevertheless preserves many characters which mark it as a representative of a distinct species.

The dorsal cup was apparently truncate bowl-shaped. There is a distinct basal concavity, the width of which, by rough estimate, was about one-fifth that of the cup. The depth of the concavity cannot be determined because portions of the stem are still in place. Three columnals and part of a fourth are showing; the columnals are thin, and each is estimated to bear about 35 culmina.

---

[4] Named for Pittsburgh, Pennsylvania.

The infrabasals project slightly beyond the stem, and slope steeply downward. The circlet is evidently somewhat displaced in the present specimen, but the tip of one of the plates appears to be nearly in its original place, indicating that the plate leveled off distally into a triangular area that fitted in between adjacent basals.

Evidently the only participation of the basals in the basal concavity was in the form of a sharp curvature of their proximal portions that contributed to form a slight part of the wall of the concavity. Despite compaction, it is apparent that the slopes of the basal circlet were fairly gentle. The basal plates are a little wider than long, and are relatively large. In general they are moderately convex, although there are broad hollows bordering the basal sutures, and deep pits at the angles where they meet the radials, the radianal, and anal X.

It is difficult to estimate the original slopes of the radials, but from all appearances they did not deviate sharply from those of the basals, and this would have made for a bowl-shaped cup. The radials are gently convex longitudinally and transversely. These plates are about two-fifths wider than long. The interradial notches are slight. Details of the articular surfaces are poorly preserved because of wear. The outer ligament area was apparently shallow in comparison with the inner area, and bore denticles. The outer ligament furrow is slitlike; I cannot distinguish a distinct ligament pit. There are traces of the transverse ridge, which quite evidently did not extend the full width of the plate. There are indications of fairly strong oblique fossae. The intermuscular notch is broad and the slopes of the muscle areas faced outward.

The radianal is a large plate which approximates anal X in size; the right tube plate is smaller. The proximal tip of the radianal extends to the suture between the posterior basal and the right posterior basal. On the left a sharp angle of the radianal limits, but does not cut off, the contact of anal X with the posterior basal below. On the right, the radianal extends to the tip of the right radial; distally the radianal bears the right tube plate. The right tube plate extends a short distance below the summit of the right posterior radial and its entire left side abuts against anal X. The left side of anal X contacts the left posterior radial. Details of the articular surfaces of anal X and the right tube plate are obscure, although the place of the outer ligament area in anal X is indicated

by traces of denticulations. I think it is quite likely that the articular surfaces of these two plates were in the same plane.

Two axillary primibrachs are preserved. These plates are wider than high, somewhat constricted at the sides, and lack keels. The articular surfaces for the secundibrachs resemble those of the radials, except that there is a definite ligament pit in the outer ligamentary area.

Discussion: In several respects this species resembles *Plummericrinus uddeni* (Moore and Plummer) although in *P. pittsburghensis* the interradial notches are apparently less prominent, pits are present at the corners of plates, and there is a narrow contact between the posterior basal and anal X. In the holotype of *P. uddeni* the radianal is interposed between the posterior basal and anal X, consequently the latter two plates are not in contact. This arrangement of anal plates probably prompted Strimple (1961, p. 94) to refer *P. uddeni* to *Texacrinus*. However, as I have pointed out previously (p. 13) some species of *Plummericrinus* show this plate arrangement as a variation, and it may be anticipated that the same variation will be found in *P. pittsburghensis* when additional specimens are available.

Linear measurements, in millimeters, of the holotype specimen are summarized below. Because the specimen has been subject to compaction, length, rather than height measurements of the plates were taken.

Greatest width of cup	15.0*
Width of basal concavity	3.0
Width of infrabasal circlet	3.9
Length of basal (raB)	4.5
Width of basal (raB)	4.8
Length of radial (aR)	3.7
Width of radial (aR)	6.2
Length of suture between basals	2.8
Length of suture between radials	2.1
Length of radianal	3.9
Width of radianal	3.7
Length of anal X	3.5
Width of anal X	4.0
Length of right tube plate	2.6
Width of right tube plate	2.9
Length of first primibrach (C ray)	4.1
Width of first primibrach (C ray)	4.9

* Estimated

REFERENCES CITED

Meek, F. B., 1871, Lists of Carboniferous fossils from West Virginia—description of new species: *In* Stevenson, J. J., A geological examination of Monongalia County, West Virginia: West Virginia Univ. Board Regents Rept. 3, p. 68-73.

Moore, R. C., 1939, New Crinoids from Upper Pennsylvanian and Lower Permian rocks of Oklahoma, Kansas and Nebraska: Denison Univ. Bull., J. Sci. Lab., v. 34, p. 171-272.

———————— 1940, Crinoids from the Upper Carboniferous and Permian strata in Texas: Univ. Texas Bull. 3945, p. 1-468.

Murphy, J. L., 1966, The Pennsylvanian pelecypod genus *Palaeoneilo* Hall and Whitfield: Jour. Paleontology, v. 40, p. 867-876.

Price, J. M. Jr., 1917, The Uffington shale of West Virginia—absence of marine fauna. *In* Hennen, R. V., Braxton and Clay Counties: West Virginia Geol. Survey County Rept. p. 807-816.

Stevenson, J. J., 1871, A geological examination of Monongalia County, West Virginia: West Virginia Univ. Board Regents Rept. 3, p. 40-67.

Strimple, H. L., 1952, The arms of *Haerteocrinus*: Washington Acad. Sci. Jour. v. 42, p. 245-248.

———————— 1961, Late Desmoinesian crinoids: Oklahoma Geol. Surv. Bull. 93, p. 3-189.

MANUSCRIPT RECEIVED JUNE 19, 1968